

NASA SBIR/STTR Technologies

High-resolution detector for at-wavelength metrology of X-ray optics
Radiation Monitoring Devices, Inc. - 44 Hunt Street, Watertown, MA 02472
Contract No.: NNX11CH32P



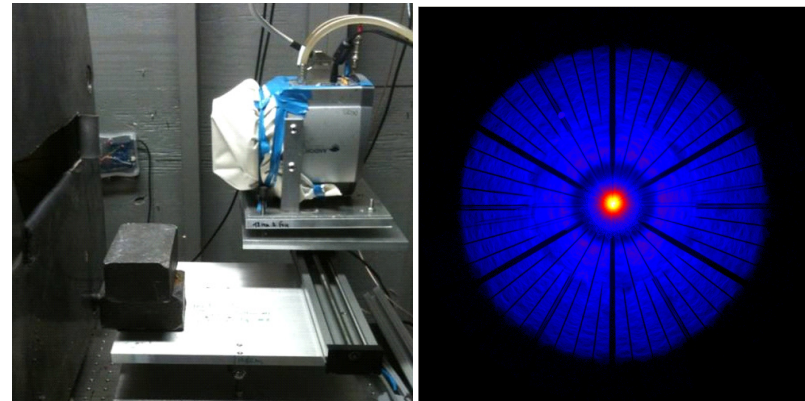
Identification and Significance of Innovation: The August, 2010 Decadal Survey highlights the important contribution that X-ray astronomy can make to address some of the most pressing scientific questions about black holes, cosmology and the ebb and flow of energy and matter in the evolving universe. It also emphasizes that while missions like the International X-ray Observatory (IXO) can address these issues, much research must be conducted to mature the key enabling technology, X-ray optics. The proposed development directly addresses this need by providing a unique detector designed specifically to support the development of the next generation of X-ray telescopes, which will allow researchers and engineers to characterize such X-ray telescopes with high accuracy, and thereby optimize their performance and best utilize the data they gather.

Estimated TRL at end of Phase I contract: 5.

Technical Objectives: Design and fabricate a dedicated 2D X-ray camera with high spatial and spectral resolution to test, characterize and calibrate the next generation of all NASA X-ray telescopes that operate in the energy range from a few keV up to nearly 100 keV. Fully test and qualify the device at Nevis and on site at NASA.

Work Plan: The Work Plan had three distinct primary areas:

- Develop protocols to deposit high resolution microcolumnar scintillator films to maximize light input into electron multiplying CCD (EMCCD) while preserving spatial resolution.
- Develop algorithms and software to achieve sub-pixel spatial resolution with moderate energy resolution.
- Integrate new components and software with our existing EMCCD camera and perform feasibility tests at the Rainwater Memorial Calibration Facility (RaMCaF) for testing NuSTAR mission optics.



(Left) RMD detector on a translational stage in RaMCaF beamline.
(Right) Point Spread Function (PSF) of one of the NuSTAR flight optics as measured by this detector.

NASA Applications: X-ray optics development support for specific missions and mission areas, including an International X-ray Observatory (IXO) like future mission, the Nuclear Spectroscopic Telescope Array (NuSTAR), hard X-ray solar astronomy (e.g., the Focusing Optics X-ray Solar Imager, FOXSI), and X-ray detectors that can be used for characterizing any X-ray telescope at NASA MSFC.

Non-NASA Applications: High resolution X-ray/ γ -ray detection, small animal single photon emission computed tomography (SPECT), time-resolved X-ray diffraction studies at synchrotron sources, dynamic X-ray imaging of hypervelocity projectiles, X-ray microscopy, and low-light optical tomography.

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NON-PROPRIETARY DATA